4.7 Graph Linear Functions

Goal • Use function notation.

VOCABULARY

Function notation A way to name a function that is defined by an equation; $f(x) = mx + b$

Family of functions A group of functions with similar characteristics

Parent linear function The most basic linear function in a family of linear equations: $f(x) = x$

Example 1 *Find an x-value*

For the function $f(x) = 3x + 1$, find the value of x so that $f(x) = 10$.

Solution

$f(x) = 3x + 1$	**Write original equation.**
$\underline{10} = 3x + 1$	**Substitute __10__ for $f(x)$.**
$\underline{3} = x$	**Solve for x.**

When $x = \underline{3}$, $f(x) = 10$.

✔ *Checkpoint* **Complete the following exercises.**

1. For $f(x) = 6x - 6$, find the value of x so that $f(x) = 24$.

$x = 5$

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2. For $f(x) = 7x + 3$, find the value of x so that $f(x) = 17$.

$x = 2$

Example 2   *Graph a function*

Text Messages A wireless communication provider estimates that the number of text messages m (in millions) sent over several years can be modeled by the function $m = 120t + 95$ where t represents the number of years since 2002. Graph the function and identify its domain and range.

t	m
0	95
1	215
2	335
3	455

Years since 2002
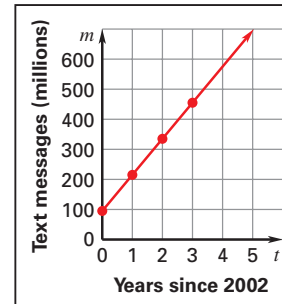
The domain of the function is $t \geq$ 0 . From the graph or table, you can see that the range of the function is $m \geq$ 95 .

✔ *Checkpoint* **Complete the following exercise.**

3. Use the model from Example 2 to find the value of t so that $m = 1055$. Explain what the solution means in this situation.

8; There will be over one billion text messages in 2010.
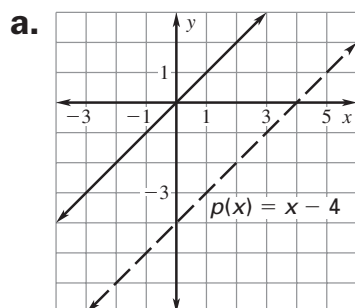
PARENT FUNCTION FOR LINEAR FUNCTIONS

1. The parent linear function is the most basic linear function.

2. $f(x) = x$ is the form of the parent linear function.

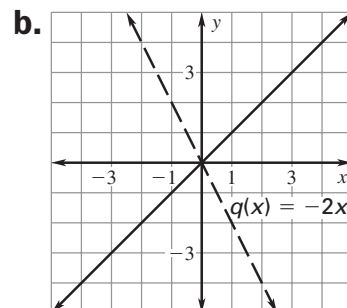**Example 3**   *Compare graphs with the graph f(x) = x*

Graph the function. Compare the graph with the graph of $f(x) = x$.

**a.** $p(x) = x - 4$ **b.** $q(x) = -2x$

Solution

a.

Because the graphs of p and f have the same slope, $m = 1$, the lines are __parallel__. Also, the y-intercept of the graph of p is __4__ less than the y-intercept of the graph of f.

b.

Because the slope of the graph of q __falls__ from left to right and the slope of the graph of f __rises__ from left to right, the slope of q is __negative__. The y-intercept of both graphs is __0__.

✔ *Checkpoint* **Complete the following exercise.**

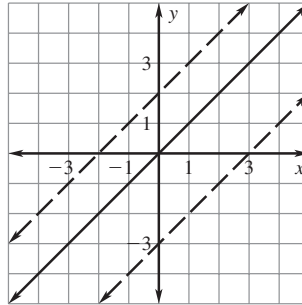**4.** Graph $r(x) = \dfrac{1}{2}x$. Compare the graph with the graph of $f(x) = x$.
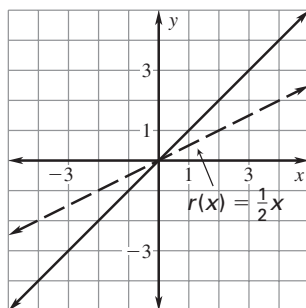
The slope of the graph of r is less than the slope of f. The y-intercept for both graphs is 0.

COMPARING GRAPHS OF LINEAR FUNCTIONS WITH THE GRAPH OF $f(x) = x$

$g(x) = x + b$
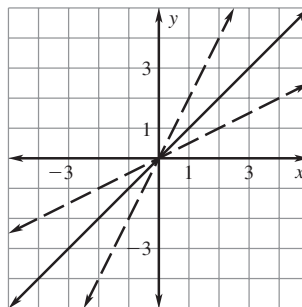

The graphs have the same <u>slope</u> .

The graphs have different <u>y-intercepts</u> .

Graphs of this family are <u>vertical translations</u> of the graph of $f(x) = x$.

$g(x) = mx$ where $m > 0$

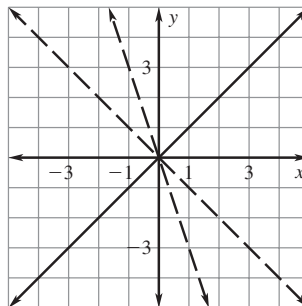
The graphs have different (positive) <u>slopes</u> .

The graphs have the same <u>y-intercept</u> .

Graphs of this family are vertical <u>stretches</u> or <u>shrinks</u> of the graph of $f(x) = x$.

$g(x) = mx$ where $m < 0$

The graphs have different (negative) <u>slopes</u> .

The graphs have the same <u>y-intercept</u> .

Graphs of this family are vertical <u>stretches</u> or <u>shrinks</u> or <u>reflections</u> of the graph of $f(x) = x$.

Homework